



Rocky Mountain
Remediation Services, L.L.C.

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RF/RMRS-97-137

**Field Sampling Plan
To Support The Final Disposition Of Soil
From The Operable Unit No. 9
Source Removal Project
C-5 Roll-Off**

Rocky Mountain Remediation Services, L. L. C.

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FIELD SAMPLING PLAN
TO SUPPORT THE FINAL DISPOSITION OF SOIL
FROM THE OPERABLE UNIT NO. 9
SOURCE REMOVAL PROJECT
ROLL OFF C-5

JANUARY 1998

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1/22/98
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1/21/98
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ATTACHMENTS

1.0	OU-9 Sample And Analysis Report
2.0	Draft OU-9 Field Sampling Plan Recommendations

ACRONYMS

APO	Analytical Projects Office
EPA	Environmental Protection Agency
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FSP	Field Sampling Plan
HPGe	High-purity germanium survey
IHSS	Individual Hazardous Substance Site
K-H	Kaiser-Hill Company, L.L.C.
OU	Operable Unit
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
QC	Quality Control
RCT	Radiological Control Technician
RFEDS	Rocky Flats Database System
RFETS	Rocky Flats Environmental Technology Site
RMRS	RMRS Rocky Mountain Remediation Services, L.L.C.
SOPs	Standard Operating Procedures
STP	Sewage Treatment Plant
yd ³	Cubic Yard

LIST OF STANDARD OPERATING PROCEDURES (SOP)

Identification Number Procedure Title

5-21000-OPS-FO.03 *General Equipment Decontamination*

5-21000-OPS-FO.13 *Containerization, Preserving, Handling and Shipping of Soil and Water Samples*

FO - *Environmental Management Division (EMD) Operating Procedures, Volume I, Field Operations*

FIELD SAMPLING PLAN TO SUPPORT THE FINAL DISPOSITION OF SOIL FROM THE OPERABLE UNIT NO. 9 SOURCE REMOVAL PROJECT

1.0 SITE BACKGROUND

This Field Sampling Plan (FSP) was developed to support the proper disposition of soils excavated from Individual Hazardous Substance Site Operable Unit (OU) No. 9 at the Rocky Flats Environmental Technology Site. Due to its interference with Phase III of the Sewage Treatment Plant Upgrades, approximately 150 feet of the 6" vitrified clay pipe, designated as OU-9 was scheduled to be removed by excavation under a subcontract (Reference P.R. P498599). This project was conducted within an OU, but was not considered to be an Environmental Restoration activity. Before excavation of the overburden began, watertight plugs were placed in the pipe on both sides of the section to be removed. Characterization of a composite of the pipe and associated soils was taken on June 11, 1996 and June 18, 1996 in accordance with the Waste Characterization and Management Plan for Excavation of OU-9 Piping (Rocky Mountain Remediation Services, L. L. C. (RMRS) Memorandum Number GMA-002-96, dated May 7, 1996). Preliminary results indicated slightly elevated levels of radioactivity in the soil; however, no hazardous constituents were detected. As a result, the soil and pipe was excavated in the summer of 1996 and placed into the C-5 roll-off container. The sampling activities associated with the OU-9 pipe removal project are addressed in the following documents:

- *Waste Characterization and Management Plan for Excavation of OU-9 Piping*, RMRS Memorandum No. GMA-002-96, dated May 7, 1996.
- *Geoprobe Characterization Report for the OU-9 Pipe Excavation Project, Revision 0*, November 1996
- *Proposed Action Memorandum and Draft Modification of the Corrective Action Section of the Operating Permit for the Rocky Flats Environmental Technology Site*, November 6, 1995
- *Sampling and Analysis Plan for the Remediation of Ryan's Pit; Operable Unit 2*, Revision 5, August 28, 1995

The removed soil and pipe, stored in the C-5 roll-off, was characterized for isotopics during the second quarter of FY97. This soil was sampled for radionuclide content in roll-offs prior to disposition. The results of this characterization effort are presented in a separate report (See Attachment 1.0).

2.0 SAMPLING OBJECTIVES

The purpose of this sampling effort is to collect data to support the following objective:

To characterize the soil and debris (clay pipe, concrete and Personal Protective Equipment (PPE) of the OU-9 roll-off container (Number C-5) in accordance with applicable regulatory requirements so that disposition of the soils can proceed.

Preliminary data already exists from the OU-9 Pipe and surrounding Sewage Treatment Plant (STP) Upgrade Site. Some of the data was collected before excavation, some after excavation, and some during the construction phase of the STP Upgrades to help define the radiological control area. The analysis required for this sampling activity for the characterization of the soil for radionuclides was Gamma Ray Spectrometry using a high purity germanium (HPGe) detector and a multi-channel analyzer system. The HPGe analysis was conducted in accordance with Radiological Engineering Procedure 14.01, Operation of the Nomad Portable Gamma Ray Spectroscopy System. In addition, a complete isotopic analysis of the soils was performed by an independent contract laboratory. A copy of these results are presented in Attachment 1.0.

A total of four samples from roll-off container Number C-5 will be taken. The results of these analysis will be used to determine the characteristics and content of the OU-9 pipe soil. The following parameters will be included in the analysis:

Radiological Screen 60g
Gross Alpha/Beta 125g (SW-846 Method 9310)
Toxicity Characteristic Metals (SW-846 Method 1311 and 6010) 25g
Toxicity Characteristic Semi-Volatile Organics (SW-846 Method 1311 and 8270) 25g
Toxicity Characteristic Volatile Organics (SW-846 Method 1311 and 8260A) 25g
Free Liquids (Paint Filter Test SW-846 Method 9095) 25g
PCBs (SW-846 Method 8080) 200g
Particle Size Analysis

Note: Analysis is to be provided by a State of Utah Certified Laboratory.

Fundamental quality control (QC) procedures are in place for the HPGe measurement system for the OU-9 Pipe Removal soils. The primary controls of HPGe measurements resides in the pre and post energy calibration of the system based on established radiological standards. These standards are documented in Radiological Engineering Procedure 14.01. Because of the existing QCs and the justification given below, the following "typical" QC samples are described for this project:

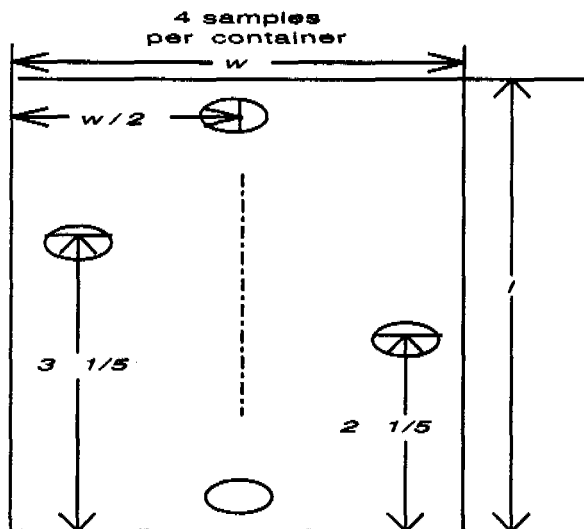
- Rinsates (equipment blanks) are not being collected because a well-established, proven procedure is being followed to decontaminate reusable sampling equipment between sample points as described in Section 5.0 of this FSP. Because decontamination procedures have been approved for use by the Analytical Projects Office (APO), equipment blanks are not necessary.
- Duplicates will be collected for a representative number of samples taken. One duplicate sample will be taken for each parameter listed above. This will provide adequate information relative to sample variability.
- Splits will be conducted for analysis as part of the routine Quality Assurance (QA) process utilized by the contract laboratory.

3.0 SAMPLE LOCATION AND FREQUENCY

Four composite core samples will be collected from one container (C-5) located at the STP as recommended by Kaiser-Hill Company, L. L. C. (K-H) statistical applications (reference letter Attachment B). To facilitate a safe sampling approach, samplers will collect samples from the sides of the roll-offs so that they are not required to climb on top of the roll-offs (e.g., required if collecting samples from the roll-offs center point). The samples will be collected near the longitudinal center lines of each roll-off container as depicted in Figure 3-1.

Four core composite subsamples (and one duplicate) will be collected from C-5 at the longitudinal center lines of each individual container (Figure 3-1). In addition, representative samples of pipe and/or concrete fragments will be taken separately from the cores to be analyzed for the parameters listed in Section 2.0 above.

Figure 3-1 Roll-Off Container Subsample Locations



Note: Pipe and concrete fragments will be selectively sampled in addition to the core composites and placed in a separate set of containers to be analyzed for the parameters listed in Section 2.0.

4.0 SAMPLE DESIGNATION

The site standard sample numbering system will be used for this project. Each sample will be assigned a unique nine digit number. The unique sample numbers have been assigned to the project by the Rocky Flats Environmental Database System (RFEDS) group. The Location Codes used for this project are "Roll off C-5". Four core samples from the container will be collected and analyzed separately for the parameters discussed in Section 2.0 above. In addition, representative samples of pipe and/or concrete fragments will be taken separately from the cores to be analyzed for the parameters listed in Section 2.0 above.

After sampling, a matrix will be developed which correlates the individual sample numbers to location codes.

5.0 SAMPLING EQUIPMENT AND PROCEDURES

Depending on availability, samples will either be collected using soil augers or core samplers and plastic bags (used to homogenize subsamples). If stainless steel sampling equipment is used, the equipment will be decontaminated in accordance with EMD Operating Procedure 5-21000-OPS-FO.03, *General Equipment Decontamination, Section 5.3.1, Cleaning Steel or Metal Sampling Equipment Without Steam in the Field*. All other sampling equipment will include standard items such as chain of custody seals and forms, logbooks, general decontamination equipment, etc. Samples will be collected from the top surface of the roll-offs in a simple manner as described in Section 3.0. The procedure to be utilized by the sampling team is titled "Waste Characterization Sampling Inside RBAs", Document Number L-6294-A.

6.0 SAMPLE HANDLING AND ANALYSIS

Samples collection will follow *Environmental Management Department Operating Procedures, Volume/Field Operations, 5-21000-OPS-FO.0.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples, Volume 1*. Samples will be placed in containers specified by the contract laboratory for the parameters indicated.

Field data will be recorded in a project log book. The originator shall authenticate (legibly sign and date) each completed original hard copy of data. A peer reviewer, someone other than the originator, shall perform a peer review on each completed original hard copy of data. Any modifications shall be lined through, initialed, and dated by the reviewer (in ink).

At project closeout, the original quality records (i.e., hard copies and digital records) will be submitted to RMRS Records Center. (Note: Digital files must be labeled with indelible ink and communicate, at least, the file name(s) and hardware and software platform(s).

7.0 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) have been developed to ensure characterization data are of known and acceptable quality and to satisfy the requirements of the treatment/disposal facility, DOT and the RFETS waste characterization program. The data generated must allow the following questions to be answered:

- Is the waste form a hazardous waste as defined by RCRA? If so, what are the applicable EPA Hazardous Waste Codes?
- What are the levels of underlying hazardous constituents? Do they meet LDR requirements? Specifically, are concentrations of hazardous constituents below the Universal Treatment Standards given in 40 CFR 268?
- What radioisotopes are present and at what levels? Do they meet the disposal facility Waste Acceptance Criteria (WAC)?
- Is the data generated by this FSP verifiable in accordance with Site Procedure L-5033, *Data Completion Assessment and Quality Control Verification*?

Analytical method requirements, discussed in Section 2.0, have been selected based on the DQOs. The associated method detection limits and quality control requirements for the chosen methods will ensure data of known and acceptable quality are collected.

7.1 90 PERCENT CONFIDENCE LIMIT

This concern is addressed by Attachment 2.0.

7.2 REPRESENTATIVENESS

This concern is addressed by Attachment 2.0.

The cube-root methodology will be used to determine the number of the samples to be collected from the population under consideration. The usefulness of the cube-root approach is provided in an internal memo from D.R. Weier to C.E. Baldwin, April 25, 1995, Discussion of Cube-Root-of-N Sample Sizes - DRW-027-95. If it is determined at additional sampling may be needed, the total number of samples required will be calculated using Equation 8 of the EPA SW-846.

7.3 SAMPLING ACCURACY

Optimum sampling accuracy will be achieved by use of a simple random approach for selecting the wastes to be sampled. A sufficient number of radiological analyses must be obtained to adequately determine the range and a weighted average of activity in the waste. There must be a sufficient number of samples analyzed by gamma spectral analysis for all natural and man-made isotopes such that they support the range and weighted average information for the waste stream that will be recorded in the waste profile. If Uranium, Plutonium, Thorium, or other non-gamma emitting nuclides are present in the material, all samples must be evaluated by radiochemistry to determine the concentration of these additional contaminants in the material.

7.4 SAMPLING PRECISION

Composite samples will be used to ensure sampling precision. The Sampling Team will make composite samples by taking four sub-samples at-depth from specified locations in each container. The size of the large-volume sample will be reduced by pouring the soil sub-samples in the center of a clean stainless steel bowl, forming the poured composites into one large pile, and removing small samples at random locations from the bowl with a flat-bottomed scoop. The material removed will be placed into several small sample containers for analysis. This process will be used for the container of waste to be sampled. The data will be used to evaluate the precision.

7.5 METHOD DETECTION LIMIT

Method detection limits (MDLs) are set by the analytical laboratory in accordance with the SW-846 analytical method.

7.6 COMPLETENESS

Through proper control of schedules and personnel, all samples anticipated by this FSP will be taken. Through application of the analytical laboratory's QA/QC program, all data generated from the analysis will be verified and useable for its intended purpose. No changes can be made to this FSP without approval of the organizations originally approving the FSP.

7.7 COMPARABILITY

All samples will be collected, analyzed, and the data evaluated using the same techniques.

8.0 REFERENCES

Final Proposed Action Memorandum for the Remediation of Individual Hazardous Substance Site 109, Ryan's Pit, RF/ER-0097.UN, August 24, 1995.

Modification to the Proposed Action Memorandum for the Remediation of Individual Hazardous Substance Site 109, Ryan's Pit, RF/ER-0097.UN, February 21, 1996.

Proposed Action Memorandum and Draft Modification of the Corrective Action Section of the Operating Permit for Rocky Flats Environmental Technology Site, November 6, 1995.

Sampling and Analysis Plan for the Initiation of Ryan's Pit; Operable Unit 2, Revision 5, August 28, 1995.

Completion Report for the Remediation of Individual Hazardous Substance Site 109, Ryan's Pit, Draft, May 1996.

RMRS, 1995. *Quality Assurance Program Plan (QAPP)*, 95-QAPP-001. Golden, Colorado. October 1995

U.S. Department of Energy. *Action Levels for Radionuclides in Soils for the Rocky Flats Cleanup Agreement, Preliminary Draft*, June 27, 1996.

Waste Characterization and Management Plan for Excavation of OU-9 Piping, RMRS Memorandum No. GMA-002-96, dated May 7, 1996.

Geoprobe Characterization Report for the OU-9 Pipe Excavation Project, Revision 0,

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Geoprobe Characterization Report for the OU-9 Pipe Excavation Project, Revision 0, November 1996.

Proposed Action Memorandum and Draft Modification of the Corrective Action Section of the Operating Permit for the Rocky Flats Environmental Technology Site, November 6, 1995.

Attachment 1.0
Sewage Treatment Plant Upgrade Project, Phase III
Containerized Soil From OU-9
Sample and Analysis Report

SEWAGE TREATMENT PLANT UPGRADE PROJECT, PHASE III
CONTAINERIZED SOIL FROM OPERABLE UNIT NO.9
SAMPLE AND ANALYSIS REPORT

This report was developed to support the proper disposition of containerized soil associated with the excavation of Individual Hazardous Substance Site (IHSS) Operable Unit (OU) No.9 at the Rocky Flats Environmental Technology Site (RFETS).

In May 1996, during Phase III of the STP Upgrades, efforts were made to locate a waste line consisting of 6-inch vitrified clay pipe. A portion of the pipe was located in the proposed STP effluent site, designated as an Individual Hazardous Substance Site (IHSS), and known as Operable Unit No. 9 (OU 9). A backhoe was used to excavate four pilot holes, in an attempt to locate the pipe. Radiological Control Technicians (RCTs) screened each bucket of soil, as it was generated, for radionuclides with a Field Instrument for the Detection of Low Energy Radiation (FIDLER). K-H Radiological Engineering had established a background measurement of 2000 cpm, based on past FIDLER surveys conducted over the entire plant site. Soil excavated from the holes indicated levels slightly above background, and a pipe fragment containing levels higher than twice background (4000 cpm) was discovered in one of the four holes. Consequently, site activities in the effluent area were temporarily suspended until characterization could be performed. A Geoprobe unit was employed to conduct sampling in the area along a predetermined grid.

In July 1996, Geoprobe sampling analyses results confirmed only the presence of radiological contamination in the effluent area. K-H Radiological Engineering determined that the soil generated by the STP Project would be handled as potential radiologically contaminated soil. 150 ft of pipe and 150 yd³ of soil excavated from within two (2) feet of the pipe was placed into a total of four (4) rolloff containers, along the east access road of the STP area. Soil excavated outside the 2-foot margin was screened with a FIDLER, and all soil containing levels greater than 4000 cpm was also placed into rolloff containers. Currently, a total of ten (10) rolloff containers occupy an area along the east access road of the STP area (Figure 1). This report documents soil sampling activities conducted in the rolloff containers from February 20, 1997 through February 25, 1997.

A total of 42 samples, including five (5) field duplicates, was collected from ten (10), 18' x 6' x 4" rolloff containers (C1 through C10) at locations indicated in Figure 2. Four samples were taken from each container, when possible, with the exception of C4, which contained only about 1 yd³ of soil among various bagged plastic liner materials. Only one sample was collected from this container. A field duplicate was collected in the first core hole in containers C1, C3, C5, C6, and C7. Each sample was given a unique temporary identification number which was correlated to a sample code assigned by the Analytical Projects Office (APO). The temporary sample numbers will be used in this report.

All analyses were performed by Thermo NuTech Laboratories. Isotopics analysis was conducted in accordance with Radiological Engineering Procedures.

ANALYSES RESULTS

A summary of sample analyses results is included as an attachment. The summary also includes a matrix correlating each sample container with a respective location code. The highest isotopic concentrations were detected in Container C5, which indicated Am 241 at 160 pCi/g in the duplicate sample of C5-A (Sample C5-A was 23 pCi/g). All of the five (5) samples collected from C5 contained detectable amounts of Pu 239, at a range of 2.5 to 14 pCi/g. All samples collected from Container C1 indicated levels of Am 241 from 1.5 to 16 pCi/g. Results for all remaining samples were close to or below background levels.

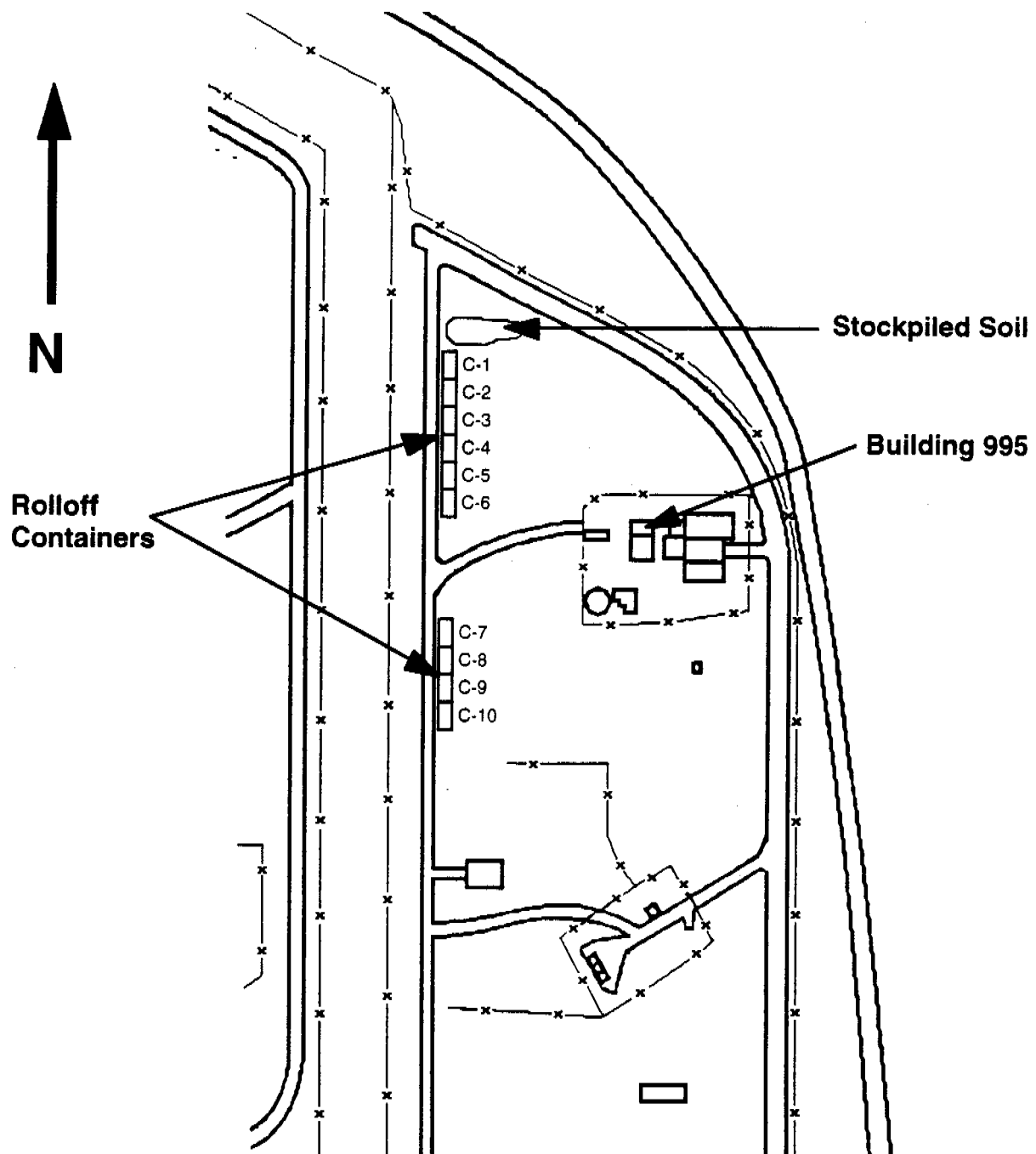


Figure 1. Location of Rolloff Containers at the Sewage Treatment Plant

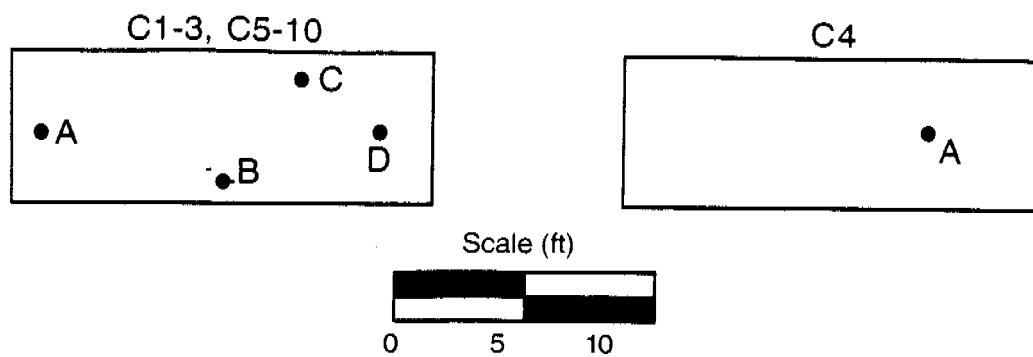


Figure 2. Soil Sample Locations

Bottle	Sample #	Collected	Analyzed	Nuclide	Results pCi/g \pm 2s	MDA
001	C1-A	02/20/97	04/03/97 03/25/97	Am241 Pu238 Pu239 U233 U235 U238	14 \pm 4.2 0.080 \pm 0.010 3.8 \pm 0.17 0.88 \pm 0.14 0.033 \pm 0.022 0.75 \pm 0.13	0.200 0.004 0.004 0.035 0.430 0.035
002	C1-B	02/20/97	04/03/97 03/25/97	Am241 Pu238 Pu239 U233 U235 U238	2.2 \pm 0.20 0.016 \pm 0.007 0.84 \pm 0.061 0.95 \pm 0.15 0.046 \pm 0.34 0.96 \pm 0.15	0.025 0.009 0.004 0.036 0.044 0.036
003	C1-C	02/20/97	04/01/97 03/25/97	Am241 Pu238 Pu239 U233 U235 U238	1.5 \pm 0.14 0.011 \pm 0.006 0.56 \pm 0.044 0.84 \pm 0.15 0.051 \pm 0.038 0.83 \pm 0.15	0.030 0.009 0.005 0.058 0.048 0.040
004	C1-D	02/20/97	04/03/97 03/25/97	Am241 Pu238 Pu239 U233 U235 U238	12 \pm 0.99 0.062 \pm 0.011 2.9 \pm 0.15 0.85 \pm 0.12 0.035 \pm 0.026 0.90 \pm 0.13	0.019 0.007 0.004 0.028 0.033 0.028
005	C2-A	02/20/97	04/04/97 03/24/97	Am241 Pu238 Pu239 U233 U235 U238	0.068 \pm 0.019 0.001 \pm 0.005 0.067 \pm 0.011 0.80 \pm 0.13 0.029 \pm 0.023 0.77 \pm 0.13	0.012 0.009 0.005 0.045 0.044 0.036
006	C2-B	02/20/97	04/02/97 03/25/97	Am241 Pu238 Pu239 U233 U235 U238	0.048 \pm 0.011 0.004 \pm 0.004 0.046 \pm 0.010 0.92 \pm 0.12 0.036 \pm 0.024 0.91 \pm 0.12	0.011 0.007 0.006 0.032 0.030 0.025
007	C2-C	02/20/97	04/02/97 03/25/97	Am241 Pu238 Pu239 U233 U235 U238	0.049 \pm 0.011 -0.003 \pm 0.004 0.057 \pm 0.012 0.76 \pm 0.097 0.048 \pm 0.026 0.80 \pm 0.10	0.010 0.010 0.006 0.032 0.024 0.025
008	C2-D	02/20/97	04/02/97 03/25/97	Am241 Pu238 Pu239 U233 U235 U238	0.053 \pm 0.011 0.004 \pm 0.006 0.063 \pm 0.012 0.78 \pm 0.090 0.050 \pm 0.021 0.79 \pm 0.090	0.005 0.010 0.007 0.027 0.020 0.025
009	C3-A	02/25/97	04/03/97 03/27/97	Am241 Pu238 Pu239 U233 U235 U238	0.097 \pm 0.015 0.002 \pm 0.003 0.088 \pm 0.014 0.99 \pm 0.074 0.86 \pm 0.021 0.97 \pm 0.072	0.010 0.005 0.005 0.020 0.010 0.017
010	C3-B	02/25/97	04/03/97 03/27/97	Am241 Pu238 Pu239 U233 U235 U238	0.058 \pm 0.012 0.003 \pm 0.005 0.066 \pm 0.012 0.76 \pm 0.066 0.059 \pm 0.019 0.76 \pm 0.064	0.010 0.008 0.004 0.024 0.015 0.016
011	C3-C	02/25/97	04/03/97 03/27/97	Am241 Pu238 Pu239 U233 U235 U238	0.072 \pm 0.011 0.001 \pm 0.003 0.097 \pm 0.014 0.76 \pm 0.67 0.043 \pm 0.017 0.74 \pm 0.064	0.008 0.007 0.004 0.018 0.110 0.013
012	C3-D	02/25/97	04/04/97 03/27/97	Am241 Pu238 Pu239 U233 U235 U238	0.078 \pm 0.013 0.002 \pm 0.003 0.097 \pm 0.014 0.79 \pm 0.065 0.039 \pm 0.016 0.76 \pm 0.063	0.009 0.005 0.005 0.018 0.011 0.013
013	C4-A	02/20/97	04/07/97 03/27/97	Am241 Pu238 Pu239 U233 U235 U238	0.42 \pm 0.055 0.006 \pm 0.007 0.29 \pm 0.029 0.86 \pm 0.078 0.047 \pm 0.021 0.81 \pm 0.075	0.016 0.011 0.006 0.018 0.017 0.018
014	N/S					
015	N/S					
016	N/S					
017	C5-A	02/20/97	04/07/97 03/27/97	Am241 Pu238 Pu239 U233 U235 U238	23 \pm 5.9 0.10 \pm 0.016 4.4 \pm 0.28 1.0 \pm 0.079 0.060 \pm 0.020 1.0 \pm 0.077	0.300 0.006 0.005 0.019 0.011 0.015
018	C5-B	02/20/97	03/27/97 04/02/97	Am241 Pu238 Pu239 U233	5.6 \pm 0.47 0.043 \pm 0.010 1.7 \pm 0.12 1.0 \pm 0.12	0.018 0.010 0.008 0.028

019	C5-C	02/20/97	04/07/97	U235	0.060 ± 0.020	0.027
			03/27/97	U238	0.92 ± 0.12	0.023
				Am241	8.3 ± 0.77	0.019
			03/31/97	Pu238	0.047 ± 0.011	0.011
				Pu239	2.5 ± 0.15	0.005
				U233	0.94 ± 0.072	0.017
				U235	0.048 ± 0.016	0.010
020	C5-D	02/20/97		U238	0.95 ± 0.072	0.015
			03/27/97	Am241	51 ± 11	0.270
				Pu238	0.34 ± 0.032	0.011
			03/31/97	Pu239	14 ± 0.81	0.006
				U233	0.98 ± 0.078	0.019
				U235	0.050 ± 0.018	0.011
				U238	0.92 ± 0.075	0.013
021	C6-A	02/27/97	04/09/97	Am241	0.83 ± 0.059	0.009
			04/04/97	Pu238	0.010 ± 0.006	0.009
			04/02/97	Pu239	0.034 ± 0.030	0.005
				U233	0.78 ± 0.15	0.048
				U235	0.015 ± 0.015	0.059
				U238	0.77 ± 0.15	0.048
022	C6-B	02/27/97		Am241	2.22 ± 0.178	0.023
			04/04/97	Pu238	0.023 ± 0.008	0.009
			04/04/97	Pu239	1.0 ± 0.072	0.004
				U233	0.63 ± 0.12	0.050
				U235	0.076 ± 0.038	0.048
				U238	0.81 ± 0.15	0.040
023	C6-C	02/27/97	04/09/97	Am241	0.28 ± 0.028	0.008
			04/04/97	Pu238	0.002 ± 0.004	0.007
			04/02/97	Pu239	0.67 ± 0.11	0.004
				U233	0.75 ± 0.18	0.070
				U235	0.022 ± 0.022	0.085
				U238	0.96 ± 0.20	0.070
024	C6-D	02/27/97	04/09/97	Am241	0.33 ± 0.031	0.008
			04/04/97	Pu238	0.004 ± 0.005	0.008
			04/02/97	Pu239	0.84 ± 0.012	0.006
				U233	0.69 ± 0.15	0.052
				U235	0.008 ± 0.016	0.062
				U238	0.57 ± 0.13	0.052
025	C7-A	02/25/97	04/08/97	Am241	2.3 ± 0.18	0.015
			03/28/97	Pu238	0.017 ± 0.007	0.009
			04/02/97	Pu239	0.77 ± 0.061	0.005
				U233	0.91 ± 0.14	0.033
				U235	0.058 ± 0.032	0.040
				U238	0.89 ± 0.14	0.033
026	C7-B	02/25/97	04/08/97	Am241	0.21 ± 0.031	0.014
			03/31/97	Pu238	0.002 ± 0.006	0.010
			04/02/97	Pu239	0.085 ± 0.015	0.007
				U233	0.84 ± 0.13	0.033
				U235	0.053 ± 0.032	0.040
				U238	0.82 ± 0.13	0.033
027	C7-C	02/25/97	04/08/97	Am241	0.50 ± 0.052	0.013
			03/31/97	Pu238	0.004 ± 0.005	0.009
			04/02/97	Pu239	0.27 ± 0.027	0.007
				U233	0.84 ± 0.14	0.051
				U235	0.090 ± 0.045	0.043
				U238	0.90 ± 0.14	0.044
028	C7-D	02/25/97	04/08/97	Am241	0.95 ± 0.084	0.013
			04/02/97	Pu238	0.009 ± 0.006	0.009
			04/02/97	Pu239	0.31 ± 0.032	0.008
				U233	0.81 ± 0.14	0.060
				U235	0.033 ± 0.040	0.051
				U238	0.92 ± 0.16	0.052
029	C8-A	02/25/97	04/08/97	Am241	0.058 ± 0.015	0.011
			04/02/97	Pu238	0.003 ± 0.004	0.007
			04/02/97	Pu239	0.065 ± 0.011	0.006
				U233	0.91 ± 0.14	0.043
				U235	0.060 ± 0.033	0.041
				U238	0.94 ± 0.15	0.043
030	C8-B	02/25/97	04/08/97	Am241	0.050 ± 0.015	0.014
			04/02/97	Pu238	-0.001 ± 0.005	0.009
			04/02/97	Pu239	0.055 ± 0.010	0.004
				U233	0.77 ± 0.13	0.041
				U235	0.083 ± 0.042	0.040
				U238	0.84 ± 0.13	0.041
031	C8-C	02/25/97	04/08/97	Am241	0.074 ± 0.014	0.006
			04/02/97	Pu238	0.003 ± 0.005	0.008
			04/03/97	Pu239	0.10 ± 0.015	0.005
				U233	0.75 ± 0.15	0.041
				U235	0.071 ± 0.039	0.050
				U238	0.76 ± 0.14	0.041
032	C8-D	02/25/97	04/08/97	Am241	0.040 ± 0.012	0.009
			04/02/97	Pu238	0.003 ± 0.006	0.010
			04/02/97	Pu239	0.051 ± 0.012	0.008
				U233	0.72 ± 0.12	0.033
				U235	0.057 ± 0.032	0.040
				U238	0.90 ± 0.13	0.033
033	C9-A	02/25/97	04/02/97	Am241	0.047 ± 0.009	0.005
			04/02/97	Pu238	-0.001 ± 0.006	0.011
			04/02/97	Pu239	0.13 ± 0.019	0.008
				U233	0.70 ± 0.12	0.035
				U235	0.056 ± 0.034	0.043
				U238	0.79 ± 0.13	0.035

034	C9-B	02/25/97	04/08/97	Am241	0.042 ± 0.011	0.010
			04/02/97	Pu238	0.39 ± 0.035	0.006
			04/02/97	Pu239	0.32 ± 0.031	0.005
				U233	0.72 ± 0.13	0.034
				U235	0.049 ± 0.033	0.041
035	C9-C	02/25/97	04/09/97	U238	0.80 ± 0.13	0.034
			04/04/97	Am241	0.046 ± 0.011	0.008
			04/02/97	Pu238	0.002 ± 0.004	0.008
				Pu239	0.058 ± 0.010	0.006
				U233	0.89 ± 0.17	0.048
036	C9-D	02/25/97	04/09/97	U235	0.038 ± 0.031	0.058
			04/04/97	U238	0.69 ± 0.15	0.048
			04/02/97	Am241	0.22 ± 0.023	0.008
				Pu238	0.030 ± 0.008	0.008
				Pu239	1.7 ± 0.11	0.004
037	C10-A	02/25/97	04/09/97	U233	0.93 ± 0.17	0.055
			04/04/97	U235	0.043 ± 0.035	0.056
			04/02/97	U238	1.1 ± 0.21	0.055
				Am241	0.039 ± 0.010	0.007
				Pu238	0.0 ± 0.002	0.007
038	C10-B	02/25/97	04/09/97	Pu239	0.052 ± 0.010	0.005
			04/04/97	U233	0.81 ± 0.15	0.056
			04/02/97	U235	0.071 ± 0.043	0.054
				U238	0.73 ± 0.14	0.045
				Am241	0.051 ± 0.010	0.006
039	C10-C	02/25/97	04/09/97	Pu238	-0.001 ± 0.004	0.008
			04/04/97	Pu239	0.079 ± 0.012	0.004
			04/02/97	U233	0.64 ± 0.13	0.068
				U235	0.089 ± 0.060	0.057
				U238	0.67 ± 0.15	0.047
040	C10-D	02/25/97	04/09/97	Am241	0.047 ± 0.010	0.009
			04/04/97	Pu238	0.002 ± 0.005	0.009
			04/02/97	Pu239	0.093 ± 0.014	0.006
				U233	0.63 ± 0.14	0.057
				U235	0.043 ± 0.029	0.055
041	C1-A Dup	02/20/97	04/09/97	U238	0.69 ± 0.14	0.057
			04/04/97	Am241	0.061 ± 0.011	0.057
			04/02/97	Pu238	0.0 ± 0.005	0.009
				Pu239	0.11 ± 0.016	0.007
				U233	0.84 ± 0.15	0.057
042	C3-A Dup	02/25/97	04/09/97	U235	0.036 ± 0.029	0.055
			04/04/97	U238	0.74 ± 0.14	0.045
			03/25/97	Am241	16 ± 4.0	0.300
				Pu238	0.062 ± 0.010	0.007
				Pu239	3.0 ± 0.16	0.004
043	C5-A Dup	02/20/97	04/09/97	U233	0.88 ± 0.14	0.043
			04/04/97	U235	0.048 ± 0.032	0.041
			03/25/97	U238	0.79 ± 0.13	0.034
			03/31/97	Am241	0.042 ± 0.009	0.005
				Pu238	0.002 ± 0.004	0.008
044	C7-A Dup	02/25/97	04/09/97	Pu239	0.029 ± 0.007	0.004
			04/04/97	U233	0.98 ± 0.078	0.021
			04/02/97	U235	0.081 ± 0.024	0.110
			04/02/97	U238	0.98 ± 0.078	0.190
				Am241	160 ± 84	0.270
045	C6-A Dup	02/27/97	04/09/97	Pu238	0.19 ± 0.016	0.005
			04/04/97	Pu239	9.7 ± 0.39	0.004
			04/02/97	U233	0.88 ± 0.098	0.036
			04/02/97	U235	0.081 ± 0.033	0.021
				U238	0.89 ± 0.098	0.025
046	C6-A Dup	02/27/97	04/09/97	Am241	2.0 ± 0.14	0.010
			04/04/97	Pu238	0.017 ± 0.008	0.010
			04/02/97	Pu239	0.71 ± 0.061	0.006
			04/02/97	U233	0.95 ± 0.15	0.045
				U235	0.074 ± 0.046	0.044
047	C6-A Dup	02/27/97	04/09/97	U238	0.77 ± 0.13	0.045
			04/04/97	Am241	1.3 ± 0.10	0.015
			04/02/97	Pu238	0.007 ± 0.006	0.009
			04/02/97	Pu239	0.50 ± 0.037	0.006
				U233	0.77 ± 0.15	0.047
048	C6-A Dup	02/27/97	04/09/97	U235	0.045 ± 0.030	0.057
			04/04/97	U238	0.71 ± 0.15	0.047
			04/02/97	Am241	0.039 ± 0.010	0.007
			04/02/97	Pu238	0.002 ± 0.005	0.009
				Pu239	0.093 ± 0.014	0.006

FIELD SAMPLING PLAN TO SUPPORT
THE FINAL DISPOSITION OF SOIL
FROM THE OPERABLE UNIT NO. 9
SOURCE REMOVAL PROJECT

RF/RMRS-97-137
Revision 0
Date Effective: 01/20/98

Attachment 2.0

Draft OU-9 Field Sampling Plan Recommendations




KAISER ♦ HILL
COMPANY

INTEROFFICE MEMORANDUM

DATE: January 14, 1997

TO: Mary Aycok, RMRS Engineering Construction and Decommissioning, x5309

FROM:  Thomas R. Gatliffe, Statistical Applications, Building T130J, x6548

SUBJECT: DRAFT OU9 FIELD SAMPLING PLAN RECOMMENDATIONS - TRG-001-97

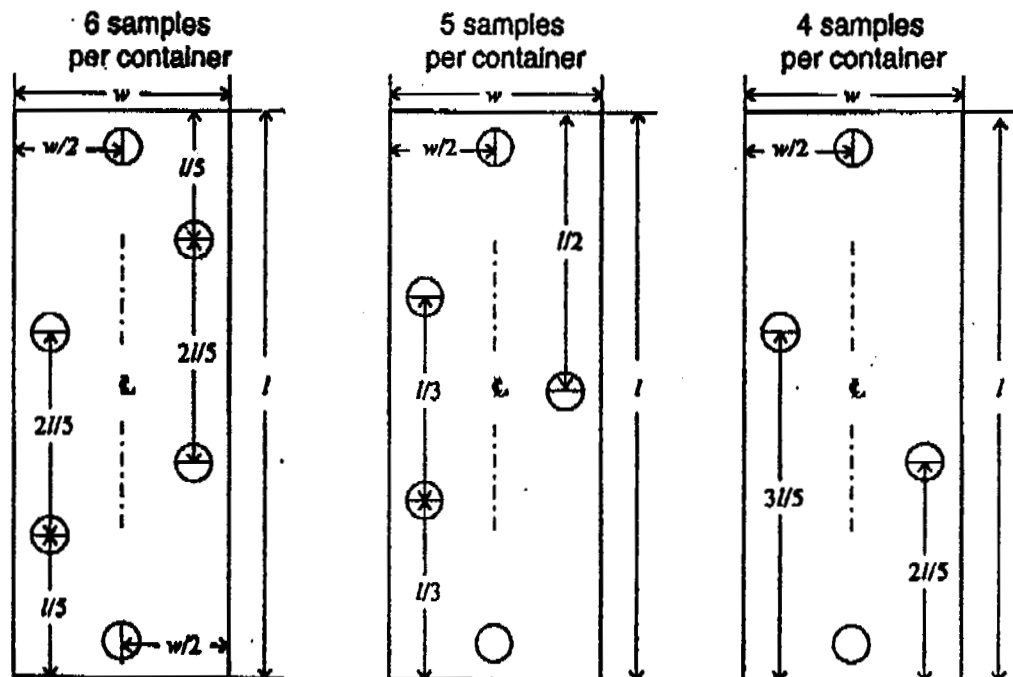
Per your telephone request of January 13, 1997, I have reviewed the draft document entitled *Field Sampling Plan To Support The Final Disposition of Soil From The Operable Unit No. 9 Source Removal Project* and dated December 1996. The following comments and recommendations are forwarded for your consideration in preparing the final document.

Because the soil/clay pipe mixture is not strictly homogeneous, any samples must be reasonably representative of the composite matrix, if the use of statistical analyses based upon the assumption of homogeneity in the sampled material is planned. For this reason the selected sampling technique should be one which can be expected to capture all components of the heterogeneous mixture in approximately the same proportions as exist in the sampled material as a whole. Thus, as feasible, the samples should be drawn from all depths of the roll-off containers to ameliorate the effects of settling of heavier components, if any. In addition, the samples locations should be approximately evenly spaced laterally across the horizontal cross-section of each roll-off container, with one or more taken near the longitudinal centerline and others off centerline to account for potential lateral stratification, if any. Although the plan calls for samples to be taken along the sides to eliminate the need for climbing on top of the roll-off containers, samples should be taken at some separation from the container sides, 12 or more inches as feasible, in order to avoid any segregation effects that the sides may have induced in the soil/pipe matrix components.

The use of only three composite samples, may not provide sufficient confidence that the true average concentration of radionuclides lies below the specified action levels, particularly if any of the sample results approach those levels in magnitude. However, if a minimum of four samples are analyzed and all lie below the action levels, there is greater than 90 percent confidence (actually at least 93.75% confidence) that the median value of the underlying concentration distribution is less than the specified action level, even if any or all of the sample results approach the magnitude of the action levels. If, as you expect, the observed values are all well less than the action levels, greater than ninety-five percent confidence that the average level of the entire contents is less than the action level should be easily achieved with only four samples. Such an approach would thus fully satisfy the EPA Document SW-846 criteria for mean concentration. The results also assume that the measures outlined above to ensure the samples are reasonably representative of the soil/pipe matrix have been taken.

Mary Aycock
January 14, 1997
TRG-001-97
Page 2

The pattern of sample locations proposed in the draft document is regular and easily implemented but suffers from the lack of any samples taken near the longitudinal centerline and the samples in adjacent grid corners are much closer together than they should be for true independence. In addition, twelve samples are probably more than is truly necessary unless there is reason to presuppose the existence of spatially discrete areas of significantly higher contamination within the contents of a roll-off container. My understanding is that previous experience with similar excavation materials does not suggest that this would be likely. Accordingly, I recommend the use of one or more of the patterns shown below for taking samples from individual roll-off containers. The approximate locations are identified in terms of the major roll-off dimensions of length, l , and width, w . If desired, the selected sample pattern may be mirrored on alternate containers to increase randomness without degrading validity.



If you have questions or desire further information concerning the information provided in this letter or if I may be of further assistance with regard to this or any other matter, please do not hesitate to contact me at your convenience.

cc:

E. J. Nuccio, Engineering Support Services